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Notes on the Subject of Infertility in Cattle*

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It has, in the past, been the custom to group together the various conditions giving rise to impaired fertility in cattle under the general term "sterility." The term is an unfortunate one in that it tends to convey the idea of a clinical entity with a homogeneity of origin—the last idea one could wish to impart. Therefore, it is pleasing to note the tendency of more recent writers to adopt the term "infertility" in its place. If, by replacing the older term by the newer, we are encouraged to remember that we are dealing with a group of widely varying conditions and not with any disease entity we shall probably obtain a more catholic outlook on the subject.

TECHNIQUE

What are the prerequisites of the student of veterinary gynaecology?

1. A thorough knowledge of the anatomy of the pelvic cavity, the physiology of reproduction, and the pathology of the genitalia; the terms "physiology" and "pathology" are used in the broad sense.
2. The ability to interpret his findings and to realise the deficiency of his knowledge.
3. A thorough knowledge of the technique involved.
4. Practice.

A good method of gaining practical experience is probably the following:—

1. To visit the abattoir and examine female cattle there before slaughter, to take notes of one's findings, and then to correlate these with the actual conditions as seen on *post-mortem* examination.
2. To examine at short regular intervals (*e.g.*, bi-weekly) the genital organs of three to six animals, noting the changes through the oestral cycle and into pregnancy. In all this preliminary work it is better to deal with a smaller number of animals thoroughly than with a larger number in a cursory fashion.

Examination of the more cranial organs must of necessity be carried out by palpation per rectum. While the technique employed by different persons varies in minor details the general procedure is as follows: The hand and arm are well lubricated and introduced into the rectum. The position of the cervix is established, it being the first "guide point" from which to work. It usually lies about 8 to 10 inches anterior to the vulva; *i.e.*, it should be felt as a hard object just below the finger tips when the arm has been introduced up to the wrist. The fingers are then moved cranial-wards, palpating the corpus uteri and the externally united cornua. At the point where the external bifurcation occurs the middle finger is hooked under the dorsal intercornual ligament and drawn caudal-wards to bring the organs into more easy reach of the operator. The left uterine horn is palpated between the fingers and thumb along its whole length, its size and "feel" being noted. The left ovary is then picked up and examined for the presence of corpora lutea, follicles, or "cystic" follicles. Examination of the ovary being completed the ovary is fixed between the ventral surface of the finger and the thumb and pushed back by the thumb towards the palm of the hand. (Plate 1.)

The first three fingers are simultaneously directed downwards, forwards, outwards, and upwards and at the same time extended in a fan-like fashion in an attempt to enter the bursa ovarii. If this operation has been performed successfully the edge of the bursa will be felt across the dorsal surface of the fingers usually between the second and third joints. (Plate 2.)

The hand is then rotated so that the palm becomes uppermost and the thumb placed in apposition to the finger-tips when the mesosalpinx will be found to lie between. (Plate 3.)

Palpation of the mesosalpinx reveals the Fallopian tube which lies for most of its course about midway between the free and the attached edges. Medialwards, where the Fallopian tube leaves the uterine horn, it lies near the free edge of the bursa. Its course runs diagonally across the mesosalpinx so that only at its uterine end does it lie at the free border. The ostium abdominale, however, lies again more toward the free edge than does the central portion of the tube and the fimbriated end spreads out fan-like near the edge of the meso-

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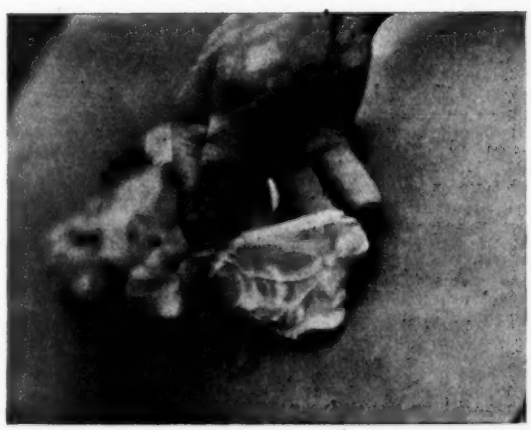
PLATE I

PLATE II

PLATE III



salpinx. It should be appreciated that palpation of the Fallopian tube is sometimes extremely difficult or may even be impossible.

Examination of the organs to the left of the medial line completed, the hand is then returned to the dorsal intercornual ligament and a similar examination made of the right side.

Interpretation of Per Rectal Findings

Ovaries.—In connection with the examination of the ovaries, Table I is included as an aid to the differentiation of corpora lutea, follicles, and " cystic " follicles.

Table I

Corpus luteum	Follicle	" Cystic " Follicle
1. Solid body which does NOT fluctuate, or does so only very slightly.	1. Vesicle which fluctuates. Deep follicles do NOT always fluctuate perceptibly.	1. Vesicle which fluctuates. Thick walled " cysts " do NOT always fluctuate perceptibly.
2. Up to about 3 cm. in diameter.	2. Up to 1·5 to 2 cm. in diameter.	2. Up to or even more than 4 cm. in diameter.
3. At its stage of maximum volume often appears to occupy more space than rest of the ovarian tissue.	3. Except in maiden heifers, usually appears to occupy only a comparatively small portion of the ovarian mass.	3. May appear to involve the whole organ.
4. Locus of ovulation can often be felt.	4. Locus of ovulation can NOT be felt.	4. Locus of ovulation can NOT be felt.

It is the author's practice to regard as a " cystic " follicle any fluctuating body of a diameter of more than 2 cm. in the ovary more than 40 hours and less than 18 days post oestrum in the absence of a corpus luteum. This is a purely personal classification.

The differentiation of a corpus luteum from a follicle situated deeply in the ovary or from a thick-walled " cyst " is not always easy. In this connection it is helpful to remember the relative size and appearance of the corpus luteum at different stages of the oestral cycle.

It will be recollected that ovulation occurs in the cow some 36 to 40 hours after the *commencement* of heat and that after ovulation the space formerly occupied by the follicle houses the corpus luteum. If one is examining a cow at frequent intervals the position of the young corpus luteum during the first 24 hours of its development can be detected as a small soft depression on the surface of the ovary. During the second day of its life the young corpus luteum is usually not appreciable as a depression or as a protuberance on the surface of the ovary. In other words, it occasions no marked variation on the general surface of the ovary. By the end of the third day, however, the corpus luteum already protrudes slightly and can be recognised by one who is tracing the ovarian changes, though it would probably not so be recognised by the casual observer. Growth proceeds rapidly, so that by the end of the fifth day it is usually readily perceptible and by the seventh day it has almost reached its maximum size which is maintained till about the 14th day. There is probably a slight increase in size from the seventh to about the eleventh day and then a gradual and slight decrease till the 14th. From the 15th day onwards regression is rapid and on the 17th the size is similar to what it was about the fifth. From then onwards it is no longer readily detectable per rectum though the regular observer may be able to recognise it.

Fallopian Tubes and Ovarian Bursae.—The Fallopian tube is usually of the diameter of a thin piece of string, its greatest diameter being reached as it approaches the ostium abdominale.

As the fingers enter the ovarian bursae the presence or absence of adhesions between the dorsal and ventral folds will be noted. These adhesions, caused by local peritonitis, indicate the former existence of inflammation in that area with possible damage to the Fallopian tube. It must be remembered that mere bursitis, unless very severe, does not preclude the possibility of the animal becoming pregnant even when the bursitis is bilateral. Rowson[1] has recorded that animals showing evidence of local peritonitis in the ovarian bursae may become pregnant in the horn of the affected side. This fact has been confirmed by other workers. Therefore, the finding of ovarian bursitis must be interpreted along with the findings in the genital organs themselves and should not, in itself—unless very severe and bilateral—lead one to pronounce an animal as permanently infertile. One would appear justified in giving a guarded prognosis.

Diagnosis of Endometritis.—Consideration must be given to the stage of the oestral cycle at which examination is made in interpreting the findings in the uterus. At oestrum and for the first day post oestrum the uterine musculature, sensitised by oestrone to the oxytocic hormone from the pituitary, contracts readily so that on examination the uterus appears firm and comparatively hard. Contraction and relaxations may be felt. This normal super-tonic condition tends to mask the actual condition of the organ, making oestrum an unsuitable time to carry out examination for the presence or absence of other than gross alteration in the size and character of the uterus. In cases exhibiting marked endometritis the organ is usually somewhat enlarged and presents what may be described as a " doughy " feeling. Hignett[2] and Brownlie[3] working independently, have reported that, in some cases, massage per rectum will cause the exudation into the vagina of mucopurulent material even when there is no evidence of vaginal discharge or of pathological enlargement of the uterus. This, however, is not a constant feature of the lesion and its absence should not rule out the possibility of endometritis existing.

Physiological Infertility

During recent years the attempt to control bovine infertility has greatly interested the veterinary profession and the pathological aspect of the problem has received more attention than the physiological. Some workers have criticised this stressing of the pathological over the physiological. However, from observation in the field, more particularly among the dairy herds of the Midlands, it is the author's opinion that pathological infertility has been, up to the present, of greater economic importance than has physiological. Gould[4] accepts a rough estimate that at least 80 per cent. in this country is of pathological origin. His experience has been mainly in the south of England; so it would appear that there, too, the physiological takes second place to the pathological as a cause of infertility in cattle.

We have in our hands the means of control of pathological infertility to a considerable degree and these means are being more generally applied to-day than they have been. Therefore, it seems likely that we shall in time see the positions reversed and the physiological assuming the role of relatively greater economic importance.

One may sum up the position by saying that mass infertility should be attributed to " physiological " imbalance only after careful investigation has revealed the unlikelihood of a " pathological " cause being implicated.

Symptomatic Manganese Deficiency.—It is considered probable by physiologists (*e.g.*, Dukes[5]) that the ovary is concerned in two cycles, *viz.*, (i) an " oestral " cycle and (ii) a " reproductive " cycle. In the normal cow these two are related in such a way that oestrum occurs on the day preceding ovulation. (Ovulation occurs from 36 to 40 hours after the commencement of oestrum.)

Hignett has shown that where symptomatic manganese deficiency occurs ovulation may be delayed for three or four days after oestrum. In other words, the relationship of the two cycles is interfered with so that the former precedes the latter by an abnormally long space of time. The condition has been demonstrated to occur not only where the soil is deficient in manganese but also in areas where the calcium-manganese ratio has been interfered with by heavy liming. It may be detected by examining suspected animals at regular intervals post oestrum and observing when ovulation occurs.

Two lines of treatment are available :—

1. Artificial insemination at the time of ovulation.
2. Administration of manganese.

" Cystic " Disease of the Ovary.—" Cystic " disease results directly from the failure of the anterior lobe of the pituitary body to produce sufficient luteinising hormone (" metakentrin " of van Dyke and Coffin[6]). What the predisposing causes may be are at present unknown though it seems possible that imbalance in the manganese metabolism may be concerned.

The accepted line of treatment is that recommended by Hammond[7], *viz.*, to rupture the " cystic " follicle manually and then to rupture the next maturing follicle at the ensuing oestrum or in ten days if oestrum has not occurred within that time. This treatment may be repeated several times. The degree of success met with by the author has been very limited.

Allen[8] has reported three cases which showed absence of oestrum together with the presence of " cysts " in ovaries. He ruptured the " cysts " manually and in two cases gave 10 mgm. stilboestrol dipropionate intramuscularly on the same day. In the third he ruptured the " cysts " and one month later gave 15 mgm. of the same oestrogen. All three cases showed an immediate return to normal ovarian activity and eventually became pregnant.

It is possible that manganese therapy might prove useful but no report of work on this line has been published.

The author[9] working in Cambridge, in three chronic cases produced collapse of the follicles by the intravenous injection of metakentrin (L.H.) in the form of " Antuitrin S " in very large doses. The injection was given when the follicle was between 1 and 2 cm. in diameter. Collapse of the follicle followed injection and luteinisation appeared to occur but the corpus luteum did not grow. It seems probable that one would require to continue the administration of metakentrin in order to obtain growth of the corpus luteum. The cost of the dose of " Antuitrin S " required to produce apparent ovulation was £2 to £3 so that, unless a very much less expensive source of metakentrin becomes available, treatment along these lines can have no economic application.

More recently it was thought possible that if the activity of the anterior pituitary could be " damped down " so that it ceased, for the time being, to produce follicle stimulating hormone (" thylakentrin " of van Dyke and Coffin[6]), it might benefit from the enforced rest and, on recommencing its activity, might produce both metakentrin and thylakentrin. In this way a normal ovarian cycle of events might be re-established. With this idea the author began some preliminary work this winter. Prolonged oestrogen therapy was employed in an attempt to throw the anterior pituitary out of action. Results to date have not been promising.

The present position with regard to the treatment of " cystic " disease of the ovaries is extremely unsatisfactory and, except in cases seen soon after parturition, the prognosis given should be grave.

The Failure of Cows and Heifers to show signs of Oestrum.—The agricultural industry suffers considerable loss each year through the failure of non-pregnant female cattle to show signs of oestrum for long periods, sometimes for several months on end. It has been the custom to refer to such cattle simply as " anoestrous." The use of this general term, though etymologically correct, is to be regretted for it makes neither for scientific accuracy nor for successful treatment. It is known that anoestrous non-pregnant animals fall into at least two categories, *viz.*, (1) those in which the reproductive cycle appears to be normal on rectal examination, and (2) those in which rectal examination reveals an absence of reproductive activity. Many workers accept a third category, *viz.*, animals showing the condition " corpus luteum persistens."

As an aid to the clear distinction of (1) and (2) in veterinary phraseology the author[10] suggested that condition (1) should be known as " suboestrum " and that the term " anoestrum " should be reserved for (2). It is, of course, realised that this proposed nomenclature would be temporary and will require to be amended when a clearer understanding of the conditions is obtained. Henceforth, in this paper, the terms " suboestrum " and " anoestrum," " suboestrous " and " anoestrous " will be used in the above sense.

Suboestrum appears to be more common among cows than among heifers and it is thought to occur most frequently among heavy milkers. Perhaps the most likely explanation of the condition, if one adopts the idea of a dual cycle in the ovary, is that while the " reproductive " cycle is taking place the " oestral " cycle is diminished in intensity or entirely absent. It may be that the dose of oestrone which will cause symptoms of heat in a cow giving only a moderate amount of milk will be insufficient to cause similar symptoms if the animal is milking heavily.

Enucleation of the corpus luteum usually causes the animal to show signs of oestrum within eight days following operation. Animals ovulate at this ensuing oestrum.

Anoestrum is most common during the winter and early spring months in heifers in poor condition and in young cows.

It is understood that cattle in the wild state have a definite breeding season, their calves being born in spring or early summer (Hammond[11]). For the first three months after calving the females probably do not come on heat and their ovaries become more or less quiescent as do those of most animals during the non-breeding season. The comparatively sheltered conditions under which dairy cattle live, involving richer feeding and protection from the weather, would appear to encourage the animal to dispense with this period of recuperation. The result is that domestic cattle normally come on heat within the first few weeks *post partum* and continue to do so every three weeks until pregnancy supervenes. If, however, the improved conditions are insufficient to offset the strain imposed in the animal by heavy lactation or adverse weather a reversion to the primitive occurs and a case of anoestrum results.

Corpus luteum persistens.—It has been generally accepted that the corpus luteum may, in certain cases, in the absence of pregnancy or of a deciduoma in the uterus, persist for a considerable time beyond the normal heat cycle. Such cases have been described as cases of " persistent corpus luteum." It seems possible that such cases may exist. But their existence has never been authenticated and it is almost certain that most so described have been, in fact, cases of suboestrum. In the absence of definite proof it is unfortunate that the condition has been so generally accepted.

It will be appreciated that to distinguish between these three conditions at least two examinations are necessary at intervals of 7 to 14 days.

The Present Position with regard to the Use of Stilboestrol Dipropionate and Pregnant Mare Serum in the Treatment of Infertility

Stilboestrol dipropionate is one of the large group of oestrogenic compounds and it is the one which has been most frequently employed in veterinary practice. It is believed to have three distinct actions, *viz.*, (1) on the uterine muscle, (2) on the corpus luteum, and (3) on the pituitary body. (Brownlee[12].)

(1) *Uterus.*—In common with other oestrogens stilboestrol dipropionate sensitises the uterine muscle to the action of pituitrin. It has therefore been found of value in the treatment of pyometra by many workers (Gould,[13] Gould, Hignett and Steele-Bodger[14], and Rowson and Spriggs[15]). It may be given by the intramuscular or the intra-uterine route ; 20 to 25 mgm. have as a rule been employed. Results following this line of therapy have been described as " spectacular."

The writer has thought it desirable in most cases to attempt to prolong the action of the oestrogen. It has therefore been his custom to administer 20 mgm. intramuscularly and 30 to 40 mgm. subcutaneously at the same time. Alternatively, 20 mgm. have been given intramuscularly twice weekly on three or four occasions. Better results seem to have attended when the oestrogen level has been sustained in this manner than when one dose only has been employed.

Stilboestrol dipropionate has also been found useful in the delivery of mummified foetuses (Stuart[16], Powell[17], and Murray and Robertson[18]); 25 mgm. again have been found to be sufficient in most cases but in that recorded by the author and Robertson much larger and repeated doses were required. It is possible that had pituitrin therapy been combined with oestrogen treatment in this case a smaller amount of stilboestrol dipropionate would have been found effective.

Golledge[19] has recorded one case in which 25 mgm., intramuscularly, was found effective in the treatment of hydrops amnii. In this case though the amniotic fluid was expelled about ten hours after injection, pregnancy was continued to term and dead twins were born.

The fact that stilboestrol dipropionate has been found so effective in bringing about the expulsion of other deciduomata suggests that it might be useful in the treatment of cases of retained foetal membranes.

(2) *Corpus luteum.*—It is believed that this compound injected intramuscularly in doses of 20 to 25 mgm. causes immediate regression of the corpus luteum (Brownlee[12]).

Anderson[20], working in Africa with cows described as " anoestrous," found that oestrum and ovulation occurred within two or three days of the intramuscular injection of oestradiol monobenzoate —another oestrogen. It is not stated specifically whether Anderson's cows were or were not experiencing a reproductive cycle. The wording of his paper, however, suggests that they were. In other words, the present author would class them as suboestrous.

Allen[8] treated five cases of suboestrum with doses of 10 to 20 mgm. stilboestrol dipropionate intramuscularly and found that four showed symptoms of heat in from two to eight days after injection.

From a limited number of observations of cases of suboestrum treated with 30 mgm. subcutaneously the author found that, on an average, seven days elapsed between the injection and the ensuing oestrum or calculated oestrum—whichever is the earlier. When it is remembered that following subcutaneous injection the maximum oestrogen concentration in the blood is not achieved for about 36 to 48 hours one feels justified in deducting one and a half to two days from this average, the corrected figures being now five to five and a half. This means that regression of the corpus luteum has occurred within five and a half days of the maximum concentration of stilboestrol dipropionate being present in the blood, a period of time agreeing very closely with that elapsing between enucleation of the corpus luteum and the heat which follows. Practical experience would appear to support Brownlee's belief.

Use may be made of action of stilboestrol dipropionate in cases of suboestrum. The injection of 20 to 30 mgm. intramuscularly will usually obviate the necessity of enucleating the corpus luteum, an operation not without a certain, though slight, degree of risk to the animal.

(3) *Pituitary Body.*—The investigations of Gould[13] on cattle and Hammond, Hammond and Parkes[21] on sheep indicated that the injection of oestrogens into anoestrous animals may not only give rise to a symptomatic heat but may also stimulate the anterior lobe of the pituitary body to produce gonadotrophic hormones so that the heat following the injection is accompanied by the presence in the ovary of a mature follicle. It was suggested, however, that ovulation might not always occur and it was recommended that service should be withheld till the next heat.

Twenty-two anoestrous or probably anoestrous animals were treated by Allen[8] by injecting 10 to 20 mgm. stilboestrol dipropionate intramuscularly. In nine of these an ovarian cycle appears to have been initiated.

About 35 anoestrous animals were injected by the author with 20 mgm. subcutaneously or intramuscularly. In a large proportion of these, symptoms of heat developed in two or three days time ; but in all but one, a cow injected within the first three months after calving, the heat was only symptomatic. In the others no ovarian change could be detected and no cycle was initiated. In the case of the one exception pregnancy resulted from the first service following injection. Most workers in the field report similar results.

While the theory of oestrogen therapy for the anoestrous case appears sound and while the results in sheep and in some cattle support the theory, our present knowledge of its application in the field will not allow of its recommendation for such cases.

Pregnant Mare Serum.—The active principle of p.m.s. is the Follicle Stimulating Hormone (F.S.H.) of the anterior pituitary ("thylakentrin" of van Dyke and Coffin). It therefore suggests itself as a useful therapeutic agent for cases in which follicles fail to mature (*i.e.*, anoestrous cases).

Bhattacharya, Hammond and Day[22] say that (1) in anoestrous heifers 1,000 to 2,000 units of p.m.s. will induce oestrus on the second or third day following injection, (2) if p.m.s. is given in the presence of a corpus luteum cysts may develop, (3) if more than 1,500 units are given cysts may be developed, and (4) p.m.s. should never be administered at the same time as a corpus luteum is enucleated, otherwise multiple ovulations may occur.

They conclude that the injection of p.m.s. is not indicated in the treatment of any form of infertility except in the anoestrous condition when no corpus luteum can be detected in the ovary.

The author[23] injected 1,500 international units of p.m.s. subcutaneously in 19 cases of anoestrum. In only nine of these was there any apparent ovarian reaction and only six of the nine showed a reaction including corpus luteum formation. Other doses and methods of administration have been experimented with and a paper on the results of these experiments is in preparation.

The author concludes that while the application of p.m.s. to the treatment of anoestrum is a useful interim measure it is only an interim measure and the degree of success likely to follow its use is not so great as was at one time hoped.

Acknowledgment.—The author wishes to express his indebtedness to Mr. K. A. Walker, of the Royal (Dick) Veterinary College, for printing his photographs.

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Weekly Wisdom

"I protest to you, Gentlemen, that if I had to choose between a so-called university which dispensed with residences and tutorial superintendence, and gave its degrees to any person who passed an examination in a wide range of subjects, and a university which had no professors or examinations at all, but merely brought a number of young men together for three or four years, and then sent them away as the University of Oxford is said to have done sixty years since, if I were asked which of these two methods was the better discipline of the intellect, . . . which of the two courses was the more successful in training, moulding, enlarging the mind, which sent out men the more fitted for their secular duties, which produced better public men, men of the world, men whose names would descend to posterity, I have no hesitation in giving the preference to that university which did nothing, over that which exacted of its members an acquaintance with every science under the sun."—Cardinal Newman (1852), "Idea of a University," p. 145. (Quoted in Final Report of Royal Commission on University Education in London, 1913.)

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The worth of most of the vitamins was first proved for animals, and it was not till many years later that it was found that plant tissues which supply those vitamins actually fabricate them for their own needs. However, three vitamins—inositol, pantothenic acid and biotin—were first recognised as growth substances for plants, nor were they tried on animals till years later.—*Science.*

CLINICAL COMMUNICATION

Mummified Foetus in the Cat

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A four-year-old queen was brought to me with a history of being about a fortnight overdue and showing no signs of beginning parturition. She appeared in normal health, but a foetus was easily palpable in the right horn of the uterus. It was decided to try the effects of stilboestrol and 1 mgm. of the solution was injected intramuscularly. Nothing happened and a week later 10 mgm. were given. After another week 15 mgm. were tried with no results.

It was feared that adhesions had formed which prevented the expulsion of the foetus, but as the cat remained well in herself interference was withheld, and I suggested tentatively that she might never conceive again. This proved wrong. She started calling a fortnight after going home and kept it up to such an extent that the owner in desperation let her out. The result was she again arrived in kit and ten days overdue; 10 mgm. stilboestrol was injected and two days later she gave birth to a live kitten. A week later, however, she still had another kitten of the second pregnancy in the left horn. A Caesarean was discussed but postponed partly because of the danger and partly because the cat still remained fit.

She returned a fortnight later, ill and with a vaginal discharge. It was then decided to operate. The site was prepared, the animal injected with 3½ c.c. nembutal intraperitoneally. This gave complete anaesthesia until the later stages when chloroform had to be given. The mummified foetus of the second conception was found enclosed in a twist in the left horn and easily removed together with the uterine wall. The other lay transversely across the abdomen. It had penetrated the right uterine wall in two places and in doing so had formed adhesions to the right abdominal wall on one side and on the other to the mesentery and small intestine. The case seemed hopeless; nevertheless, the principal adhesions were broken down and the bowel released with difficulty. The adhesions were so numerous and strong that to remove the entire foetus was impossible. The ovaries and remaining horn were also left. The abdominal wall was sutured and a dressing of sulphonamide powder applied. Two days later, when a similar dressing was used, the cat, in spite of paralysis of the back legs, was reasonably well. A course of sulphonamide was given. There was primary healing of the wound, but pneumonia developed ten days later. This responded to M. and B. The paralysis disappeared within a fortnight, and the cat and her living kitten are well.

The three interesting points of this case are :—

1. The double uterine calamity.
2. The very large doses of stilboestrol which had to be given to have any effect.
3. The perfect recovery from an operation which was so severe that at the time it appeared hopeless.

CLEANING AND STERILISING MILK BOTTLES

In a recent article Dr. Betty C. Hobbs and Professor G. S. Wilson (*J. Hyg. Camb.*, 1943, April, p. 96) have reported on the process of cleaning and sterilising milk bottles now in use and have suggested improvements. Absolute sterility is not necessary and could not be obtained commercially; but the results of bacteriological examination of bottles alleged to be clean are not good enough to pass, though it is satisfactory that in no case were coliform bacteria recovered from the washed bottles, so the processes used would presumably destroy any pathogenic organisms present in the bottles. The conclusion is drawn that the organisms found in washed bottles are derived mainly from post-detergent treatment—that is, from rinsing waters. A suggested remedy is the addition of chlorine to the rinse waters; this is widely used in the United States, but not favoured by Hobbs and Wilson. The method they advocate is the removal of the detergent by rinse waters at too high a temperature for bacterial growth, and cooling of the bottle by external rinses with recirculated water at progressively decreasing temperatures, followed by a final internal and external rinse with cold water direct from the main. The use of caustic soda as a detergent is almost essential, but such substances as sodium metasilicate, phosphate and carbonate can be added with advantage to increase wetting, softening and deflocculating, though they cannot replace the caustic soda. Hobbs and Wilson favour the narrow-necked bottle with a press-on metal cap and condemn the wide-mouthed bottle with press-in discs. The latter have been responsible for many outbreaks of paratyphoid and typhoid in America and there is general agreement that they should be discarded as quickly as circumstances permit.—*Lancet*, 1943, May 29th, p. 686.

ABSTRACTS

[STOMACH WORM (H. contortus) INFECTION IN LAMBS AND ITS RELATION TO GASTRIC HAEMORRHAGE AND GENERAL PATHOLOGY. Andrews, J. S. (1942.) *J. Agric. Res.* **65.** 1-18.]

This article presents additional evidence (1) that infection of lambs with *H. contortus* may result in severe and even fatal anaemia; (2) that the anaemia is chiefly due to haemorrhage into the abomasum; (3) that the amount of blood lost may be estimated by an examination of the faeces; (4) that the anaemia produced is similar to that caused by periodic withdrawal of measured quantities of blood from the jugular vein; (5) that the anaemia is the result of continuous, seeping, capillary haemorrhage due to injury of the mucosa caused by the worms.

A number of cross-bred lambs were reared in a worm-free environment and were infected by administering infective larvae *per os*. From 2,000 to 181,000 infective larvae (obtained by culture from *H. contortus* eggs) were administered to these lambs in single and multiple doses. A single dose of 35,000 infective larva would undoubtedly have killed one lamb, but much larger doses were not fatal when administered in small, daily doses, indicating the development of resistance to infection in these lambs. The data obtained show that *H. contortus* infection produced a severe and sometimes fatal anaemia, blood appearing in the lambs' faeces six to ten days after infection. In lambs which recovered the anaemia was negatively correlated with faecal egg output, *i.e.*, as the egg counts declined both red cells and haemoglobin increased. No worm eggs were passed in the faeces of two fatal infections, while one non-fatal case showed an egg count of 24,800 per gramme faeces, showing that there was no correlation between the numbers of eggs passed and the fatality of the infection.

The amount of blood lost in ten days by two lambs which subsequently died was 1,492 c.c. and 2,380 c.c. (Wells calculated that 1,000 dog hookworms could produce a blood loss of 360 c.c. daily). A similar degree of anaemia was produced by withdrawing 3,560 c.c. of blood from the jugular vein of a healthy lamb. The author concludes that the gross pathology, histological findings and normal icteric index lend additional support to the view that the anaemia produced was due to gastric haemorrhage alone. W. L. S.

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[THE DISTRIBUTION OF Trichomonas foetus IN THE PREPUTIAL CAVITY OF INFECTED BULLS. Hammond, D. M., and Bartlett, D. E. (1943.) *Amer. J. vet. Res.* **4.** 143.]

It is known that the preferential site for *T. foetus* in the bull is the preputial cavity, and careful tests on four bulls showed that trichomonads were most often found on the portion of the glans penis behind the galea glandis; this part of the penis was often covered with a lot of smegma, and its mucous membrane showed numerous crevices. In diagnosis and treatment, therefore, particular attention should be paid to this part of the glans penis. It was also noted that samples of urethral flushings did not show the presence of *T. foetus*. E. C.

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[DIETARY CALCIUM AND PHOSPHORUS LEVELS AND THE VITAMIN D REQUIREMENT OF THE CHICK. Nowotarski, J. S., and Bird, H. R. (1943.) *Poultry Sci.* **22.** 72-78.]

During the course of experiments designed to investigate the stability of vitamin D under practical conditions, it was found that the effects of feeding different levels of the vitamin were masked by the high mineral content of the rations employed. When the A.O.A.C. (Association of Official Agricultural Chemists) vitamin D deficient diet, which contains approximately 0·78 per cent. each of Ca and P, was fed to one-day-old White Leghorn chicks, the bone-ash percentage at three weeks was 30·8. When this ration was supplemented with 20 A.O.A.C. units of vitamin D daily, the corresponding percentage of bone-ash was raised to 36, whereas supplementation with Ca (to 3·4 per cent.) and P (to 2 per cent.) raised the figure to 44·7. Similar results were obtained with a practical mash from which the source of vitamin D was omitted, and in which the ratio of Ca : P was 2 : 1. In these experiments, bone-ash percentage and liveweight at ten weeks were raised with increasing levels of Ca up to 4·4 per cent. It was in fact possible to produce broilers in the absence of sunlight and of a dietary source of vitamin D, but the growth rate of such birds was below normal, while the incidence of deformed breast-bones was higher than would be desirable under practical conditions, but higher levels of Ca and P intake definitely lowered vitamin D requirements.

Evidence was obtained that the A.O.A.C. vitamin D deficient diet might be improved by the addition of 0·1 per cent. choline. Improved growth, utilisation of food and feathering were noted when this supplement was added to the "mineralised" A.O.A.C. diet.

A. N. W.

REVIEW

[PRACTICAL ANIMAL HUSBANDRY. By Miller and Robertson. (3rd Edition.) 496 pages, illustrated. Published by Oliver and Boyd, price 20s.]

The first edition of Miller and Robertson's "Practical Animal Husbandry" which appeared ten years ago has already proved to be so valuable to the veterinary student that it may now be described as a "veterinary classic."

The third edition has been considerably revised and in part rewritten, bringing it in conformity with modern ideas and practice. Several chapters have been added and many new diagrams and illustrations incorporated. It is gratifying to notice the liberal references made to animal husbandry on the farm.

Additional chapters which are of particular interest deal with management of dairy cattle, description and identification of cattle, an introduction to methods of examining horses and cattle for soundness, rabbit husbandry, fur farming, and kennel management, etc. The chapter on poultry has also been considerably extended and gives a very concise description of the systems of poultry-keeping. Other useful additions are a description of signs of health in animals, a table showing the different phases of reproduction, and an appendix describing the various Acts dealing with animal breeding including the Horse Breeding Act of 1918 and the Licensing of Bulls Act.

It is regrettable that the chapter on pig management is so short but perhaps this is more than compensated for by the extensive number of other subjects discussed.

The book is still written in a very clear and concise manner enabling the reader easily to understand and visualise the methods, etc., described. Thus the chapter on dentition and ageing is so clearly written and excellently illustrated that even without having previously examined a live subject, no difficulty should be experienced in estimating an animal's age.

Although perhaps primarily intended for the student the book is bound to prove to be of extreme interest to the practitioner.

NOTES AND NEWS

The Editor will be glad to receive items of professional interest for inclusion in these columns.

Diary of Events

Aug. 26th.—Meeting of the South-Eastern Division, N.V.M.A., at Tonbridge, 2.30 p.m.

Aug. 26th.—Meeting of the West of Scotland Division, N.V.M.A., at Glasgow, 2.30 p.m.

Aug. 31st.—Special meeting of Council, N.V.M.A., at the Connaught Rooms, Great Queen Street, Kingsway, W.C.2; meetings of the Finance and General Purposes Committee, also of the joint Veterinary Officers and Public Health and the Parliamentary Committee—both at 36, Gordon Square, W.C.1.

Sept. 1st.—Meetings Editorial Committee, N.V.M.A.: Special, 10.30 a.m.; Ordinary, 2.30 p.m.

Sept. 3rd.—Meeting of the Yorkshire Division, N.V.M.A., at Leeds, 2.30 p.m.

Sept. 3rd.—Meeting of the North Wales Division, N.V.M.A., at Bangor, 2 p.m.

Sept. 3rd.—Meeting of the South Wales Division, N.V.M.A., at Llandilo, 1.30 p.m.

Sept. 29th and 30th.—**N.V.M.A. Annual Meeting and Conference, London School of Hygiene and Tropical Medicine.**

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Tuberculous Mastitis

In a number of attested herds with no recent history of reactors, cases of tuberculosis of the udder have been found.

Post-mortem examination shows a distribution of the disease leaving little doubt that the udder is the seat of the primary lesion. In practically every cow found to be so affected there is a history of udder irrigation for the treatment of mastitis and there is strong circumstantial evidence that it was through such treatment the udders were infected. This reinforces the necessity for complete sterilisation of equipment before irrigating each udder.

VETERINARY EDUCATION TRUST

Wellcome Fellow Elected

The profession will have noted with gratification the intimation recently made in our notices column of the intention of the Joint Committee of the Wellcome Foundation and the Veterinary Education Trust to award a Junior Fellowship for Veterinary Research. We have pleasure in announcing the award of the First Junior Fellowship to Mr. John Lochiel McGirr, B.SC., M.R.C.V.S., of the Veterinary Laboratory, Ministry of Agriculture and Fisheries, Weybridge. We hope to make further reference to this award in an early issue.

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Personal

RETIREMENT OF MR. E. A. P. WHITE, PORTAL VETERINARY SUPERVISOR, WATERFORD

It is with regret we announce the retirement from the position of Portal Veterinary Supervisor at the Port of Waterford of E. A. P. White, B.A., M.R.C.V.S., of the staff of the Ministry of Agriculture, Eire. He had served 34 years on the staff of the Ministry and had reached the age of 65 years. During his term of service, Pat White, as he was familiarly known, by his winning personality, ever happy disposition and courteous bearing, had endeared himself to all with whom he came in contact. By his retirement the Eire Ministry have lost the services of a keen and highly capable official.

Mr. White was made the recipient of a handsome bureau, suitably inscribed, when he and Mrs. White entertained members of his staff, at the Imperial Hotel, Waterford, on the night of Saturday the 7th inst. During the course of a most enjoyable evening Mr. White was referred to in glowing terms by his colleagues present, and after the toast "Mr. and Mrs. White" had been given, Mr. White suitably replied.

We wish both Mr. and Mrs. White every happiness in their new home, which, we understand, will be amid the quiet, pleasing beauty of the Wicklow mountains.

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Births.—HARPER.—To the wife of J. D. Harper, B.SC., M.R.C.V.S., 12, Manna Grove, Belfast, on August 8th, 1943—a son.

MUIR.—At Inverkar Nursing Home, Ayr, on August 7th, 1943, to Molly, wife of Allan H. Muir, M.R.C.V.S., Worcester—a son.

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Forthcoming Marriage.—Captain B. C. M. EDMONDS and Miss MARY BAZELEY-WILLIAMS.—The engagement is announced between Captain Basil Charles Morland Edmonds, R.A.V.C., M.E.F., only son of Mr. T. Jenkin Edmonds (late of Bombay) and Mrs. Edmonds, Cranfield Penzance, and Mary Bazeley-Williams, W.R.N.S., only daughter of Colonel N. J. Williams, M.C., V.D., Oorgaum, S. India, and Mrs. Williams, The Cliff, Penzance.

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Regulations Controlling Artificial Insemination

GOVERNMENT'S CAUTIONARY ATTITUDE TO EXPANSION OF THE PRACTICE

The Minister of Agriculture and the Secretary of State for Scotland have issued Regulations* [under Section 17 of the Agriculture (Miscellaneous Provisions) Act, 1943], applicable to England and Wales, and Scotland, respectively, for the control of artificial insemination.

The Regulations which come into operation on November 1st next, prohibit the distribution or sale of bull semen except under licence (the Scottish Regulations apply also to the semen of stallions) and specify the principal conditions to be attached to licences. The Regulations do not prohibit or restrict the artificial insemination of a dam in the same ownership as the sire from which the semen is collected.

It is stated that the purpose of the Regulations is to bring under strict control the practice of artificial insemination in order to ensure that it is not developed on wrong lines, and that licences will be granted in those cases where the licensee is able to fulfil the required conditions. "Pending, however, the results of large scale field experiments now in progress the Minister and the Secretary of State are not prepared to offer any financial encouragement and consider that any wide expansion of the practice at this stage would be premature."

* Statutory Rule and Orders, 1943, Nos. 1122 (England and Wales and 1123/S37 (Scotland). H.M. Stationery Office, 1d.

THE INSEMINATION CENTRE: OBLIGATORY VETERINARY CONTROL OF OPERATIONS

The text of the Regulations, which are dated August 2nd, 1943, is as follows for England and Wales: the Scottish Regulations are identical save for the additions necessitated by their application to the semen of stallions as well as to that of bulls:—

1.—(1) No person shall distribute or sell bull semen except under the authority of a licence issued by the Minister and in accordance with such conditions (if any) as may be attached thereto.

(2) Nothing in these Regulations shall be deemed to prohibit or restrict the artificial insemination of a cow in the same ownership as the bull from which the semen is collected.

2. A licence authorising the distribution of bull semen from an artificial insemination centre shall be subject to the following conditions and to such other conditions, if any, as may be specified in the licence:—

(*a*) All the operations conducted from the centre shall be under the effective supervision and control of a veterinary surgeon approved by the Minister for the purpose.

(*b*) No person shall be employed in the collection and storage of semen and in the performance of the operation of artificial insemination unless approved by the Minister for that purpose.

(*c*) The premises on which the semen is collected and stored, and the equipment used for and the methods employed in the collection and storage of semen, shall be approved by the Minister.

(*d*) No semen shall be collected from a bull unless it has been approved for the time being by the Minister for the purpose.

(*e*) The licensee shall keep a record showing, in respect of each bull approved by the Minister, the date and place of each artificial insemination of a cow and the name and address of the owner of the cow; such records shall be open to inspection at all reasonable times by an officer of the Ministry.

3. The Minister may at his discretion grant a licence authorising the distribution or sale of bull semen other than from an artificial insemination centre for any purpose approved by him, subject to such conditions, if any, as may be specified in the licence.

Interpretation

4. This embodies the intimation that an "artificial insemination centre" means any premises used for the purpose of providing a service for the artificial insemination of cows—or (in the case of Scotland) mares—with semen collected under the control of the licensee.

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DESIGN AND CONSTRUCTION OF FARM BUILDINGS

COMMITTEE APPOINTED FOR SCOTLAND

The Secretary of State for Scotland has set up a Committee to consider and make recommendations regarding the lay-out, design and construction of farm buildings after the war. Mr. William C. Davidson, who is factor of Sauchie Estates, Stirling, has been appointed Chairman, and the membership consists of Mr. Charles Jamieson, of the Farm Servants' Union; Mr. Alexander Kirkpatrick, a Dumfriesshire farmer; Mr. J. R. Lockie, County Clerk of Ayr; Major J. G. M'Gregor, who is an expert on veterinary questions; Mr. John Mackie, of the Bent, Kincardineshire, farmer and member of the Scottish Agricultural Advisory Council; the Earl of Mansfield, and Mr. William Salmond, of Dundee, Fellow of the Royal Institute of British Architects. Assessors have also been appointed representing the Departments of Agriculture and Health for Scotland, and the Ministry of Works. The general aim of the Committee will be to arrive at a set of constructional plans, adapted to the changes in Scots agriculture brought about by mechanisation and the progress of scientific farming, so that practical designs for average types of farms will be available as soon as building again becomes possible.

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UNIVERSITY OF LONDON EXAMINATIONS IN VETERINARY SCIENCE

Following is the Pass List for the July, 1943, Examinations in Veterinary Science of the University of London:—

First Examination (for internal students): Boyden, Stephen Vickers, and Williams, Gareth (Royal Veterinary College); the following Higher School candidates have completed exemption from the First Veterinary Science: Calderbank, George, and Marchant, Irene Florence.

First Examination (for external students): the following Higher School candidate has completed exemption from the First Veterinary Science: Warren, Alan George, Royal Veterinary Coll. and Pr. st.

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N.V.M.A. PUBLICATIONS: No. 11

Artificial Insemination of Cattle: A Brief Review of the Technique

On the last page of the above publication, issued to members with *The Veterinary Record* of August 14th, the address of the English Jersey Cattle Society is given as 51, Hillcrest Gardens, Esher, Surrey.

We are informed that this Society has now returned to London and that communications should no longer be sent to Esher, but to 19, Bloomsbury Square, London, W.C.1.